REMARKS

Claims 16-22 were previously pending in the application. New claim 23 is added. Therefore, claims 16-23 are presented for consideration.

Claims 16-22 are rejected as unpatentable over CHAN et al. 6,468,906 in view of MCTEER 5,939,788 and further in view of SMITH et al. 6,255,233.

Reconsideration and withdrawal of the rejection are respectfully requested because the references do not teach or suggest a first diffusion barrier film directly on a first insulating film that suppresses aggregation of copper and that prevents diffusion of copper. The references also fail to teach or suggest that a second diffusion barrier film is directly on the first diffusion barrier film and that the second diffusion barrier film is an etch stop layer.

As noted in the Official Action, CHAN et al. fail to disclose a multilayer diffusion barrier. Accordingly, MCTEER and SMITH et al. are combined with CHAN et al. in an attempt to overcome the shortcomings of CHAN et al.

As set forth in the Official Action, Figure 16 of MCTEER teaches a multilayered structure including layers 18 and 19. Column 23, lines 35-60 of MCTEER in describing Figure 16 teach that layer 18 is an aluminum diffusion barrier layer and layer 19 is a wetting layer for aluminum. There is no teaching or suggestion in MCTEER that layers 18 and 19 would be effective

to prevent diffusion of copper. MCTEER teaches a $Ti_xAl_yN_z$ barrier layer that is effective as a diffusion barrier layer for copper. However, as seen in Figure 16 of MCTEER, the $Ti_xAl_yN_z$ barrier layer is single layer 2 surrounding copper layer 3. MCTEER does not teach a multilayer structure that prevents diffusion of copper.

In addition, MCTEER is silent as to whether layers 18 or 19 would suppress the aggregation of copper. Since these layers do not come in contact with the copper layer, it does not appear that MCTEER would use these layers to suppress the aggregation of copper.

SMITH et al. also teach a multilayer barrier structure 150, 160. Layers 150 and 160 are part of a silicon nitride/silicon oxynitride/silicon oxide stack that SMITH et al. uses as disclosed on column 6, lines 58-65 to avoid contamination of the silicon nitride surface. SMITH et al. do not disclose or suggest that the silicon nitride surface 150 or the silicon oxynitride surface 160 would suppress the aggregation of copper. In fact, column 6, lines 20-22 of SMITH et al. teach that the temperature of the substrate 300 is approximately 375 to 450°C. Such range is outside the range of suppressing aggregation of copper. Specifically, column 7, lines 12-16 of the present application disclose that the aggregation of copper is suppressed at temperatures less than 350°C.

MPEP §2173.05(g) states that a functional limitation must be evaluated and considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used. A functional limitation is often used in association with an element, ingredient, or step of a process to define a particular capability or purpose that is served by the recited element, ingredient or step.

It was held that the limitation used to define a radical in a chemical compound as "incapable of forming a dye with said oxidizing developing agent" although functional, was perfectly acceptable because it set definite boundaries on the patent protection sought. *In re Barr*, 444 F.2d 588, 170 USPQ 33 (CCPA 1971).

The limitation of suppressing the aggregation of copper has definite boundaries. As noted above, the only reference that teaches a specific substrate temperature (SMITH et al.) is outside the defined boundaries. Therefore, one of ordinary skill in the art attempting to suppress the aggregation of copper would not look to the teachings of SMITH et al. or MCTEER to combine these teachings with CHAN et al. to render obvious claim 16 of the present application.

Therefore, claim 16 and the claims which depend therefrom are believed patentable over the cited prior art.

In addition, the dependent claims include features not disclosed or suggested by the proposed combination of references. Specifically, claim 19 provides that the bottom of the second interconnect contacts walls of the first interconnect.

Claim 21 provides that the first and second diffusion barrier films are the same and have different thicknesses. MCTEER teaches that layers 18 and 19 are both approximately 300 angstroms. SMITH et al. teach that layer 150 is silicon nitride and layer 160 is silicon oxynitride.

New claim 23 provides that a bottom of the metal barrier layer of the first interconnect directly contacts an end of the walls of the metal barrier layer of the second interconnect. Only CHAN et al. teach the metal barrier layer. As seen in each of Figures 1G, 2K and 4C of CHAN et al., the bottom of the second interconnect is not as wide as the top of the first interconnect such that the bottom of the metal barrier layer of the second interconnect does not directly contact an end of the walls of the metal barrier layer of the first interconnect.

Accordingly, the above-noted dependent claims are believed patentable regardless of patentability of claim 16 from which they depend.

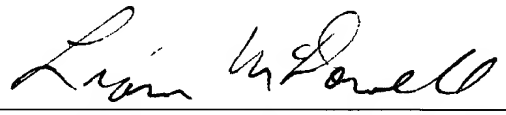
In view of the present amendment and the foregoing remarks, it is believed that the present application has been

placed in condition for allowance. Reconsideration and allowance are respectfully requested.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON



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